What is claimed is:

1. A method for producing an etch resistant image, which comprises:

(a) coating and drying a photosensitive composition onto a substrate, which photosensitive composition comprises:

(i) at least one water insoluble, acid decomposable polymer which is substantially transparent to ultraviolet or x-ray radiation, wherein said polymer is present in the photosensitive composition in an amount sufficient to form a uniform film of the composition components when it is coated on a substrate and dried;

(ii) at least one photosensitive compound capable of generating an acid upon exposure to sufficient activating ultraviolet, electron beam or x-ray radiation energy, said photosensitive compound being present in an amount sufficient to substantially uniformly photosensitize the photosensitive composition;

(b) imagewise exposing the photosensitive composition to sufficient activating ultraviolet, electron beam or x-ray radiation energy to cause the photosensitive compound to generate sufficient acid to decompose the polymer in the imagewise exposed areas of the photosensitive composition;

(c) developing the photosensitive composition to thereby remove the exposed nonimage areas and leaving the unexposed image areas of the photosensitive composition;

(d) irradiating the image areas of the photosensitive composition to sufficient electron beam radiation to thereby increase the resistance of the photosensitive composition in the image areas to an etchant while simultaneously cooling the photosensitive composition during electron beam radiation to maintain the photosensitive composition at a temperature of less than about 20 °C.

2. The method of claim 1 wherein the at least one water insoluble, acid decomposable polymer is substantially transparent to ultraviolet radiation at a

wavelength of about 157nm; wherein the at least one photosensitive compound is capable of generating an acid upon exposure to sufficient activating energy at a wavelength of about 157nm; and wherein the imagewise exposing of the photosensitive composition to sufficient activating energy is conducted at a wavelength of about 157nm.

3. The method of claim 1 wherein the at least one water insoluble, acid decomposable polymer is substantially transparent to ultraviolet radiation at a wavelength of about 193nm; wherein the at least one photosensitive compound is capable of generating an acid upon exposure to sufficient activating energy at a wavelength of about 193nm; and wherein the imagewise exposing of the photosensitive composition to sufficient activating energy is conducted at a wavelength of about 193nm.

4. The method of claim 1 wherein the at least one water insoluble, acid decomposable polymer is substantially transparent to ultraviolet radiation at a wavelength of about 248nm; wherein the at least one photosensitive compound is capable of generating an acid upon exposure to sufficient activating energy at a wavelength of about 248nm; and wherein the imagewise exposing of the photosensitive composition to sufficient activating energy is conducted at a wavelength of about 248nm.

5. The method of claim 1 wherein the at least one water insoluble, acid decomposable polymer is substantially transparent to x-ray wavelength radiation; wherein the at least one photosensitive compound is capable of generating an acid upon exposure to sufficient activating energy at x-ray wavelengths; and wherein the imagewise exposing of the photosensitive composition to sufficient activating energy is conducted at an x-ray wavelength.

6. The method of claim 1 wherein the at least one photosensitive compound is capable of generating an acid upon exposure to sufficient activating electron beam radiation; and wherein the imagewise exposing of the photosensitive composition to sufficient activating energy is conducted by electron beam radiation.

7. The method of claim 1 wherein the irradiating to electron beam radiation is conducted at a temperature of from about –10 °C to about 10 °C.

8. The method of claim 1 wherein the irradiating to electron beam radiation is conducted at a temperature of from about –10 °C to about 5 °C.

9. The method of claim 1 wherein the irradiating to electron beam radiation is conducted under vacuum conditions.

10. A method for producing a microelectronic device image, which comprises:

(a) coating and drying a photosensitive composition onto a semiconductor substrate, which photosensitive composition comprises:

(i) at least one water insoluble, acid decomposable polymer which is substantially transparent to ultraviolet or x-ray radiation, wherein said polymer is present in the photosensitive composition in an amount sufficient to form a uniform film of the composition components when it is coated on a substrate and dried;

(ii) at least one photosensitive compound capable of generating an acid upon exposure to sufficient activating ultraviolet, electron beam or x-ray radiation energy, said photosensitive compound being present in an amount sufficient to substantially uniformly photosensitize the photosensitive composition;

(b) imagewise exposing the photosensitive composition to sufficient activating ultraviolet, electron beam or x-ray radiation energy to cause the photosensitive

compound to generate sufficient acid to decompose the polymer in the imagewise exposed areas of the photosensitive composition;

(c) developing the photosensitive composition to thereby remove the exposed nonimage areas and leaving the unexposed image areas of the photosensitive composition;

(d) irradiating the image areas of the photosensitive composition to sufficient electron beam radiation to thereby increase the resistance of the photosensitive composition in the image areas to an etchant while simultaneously cooling the photosensitive composition during electron beam radiation to maintain the photosensitive composition at a temperature of less than about 20 °C.

11. The method of claim 10 wherein the at least one water insoluble, acid decomposable polymer is substantially transparent to ultraviolet radiation at a wavelength of about 157nm; wherein the at least one photosensitive compound is capable of generating an acid upon exposure to sufficient activating energy at a wavelength of about 157nm; and wherein the imagewise exposing of the photosensitive composition to sufficient activating energy is conducted at a wavelength of about 157nm.

12. The method of claim 10 wherein the at least one water insoluble, acid decomposable polymer is substantially transparent to ultraviolet radiation at a wavelength of about 193nm; wherein the at least one photosensitive compound is capable of generating an acid upon exposure to sufficient activating energy at a wavelength of about 193nm; and wherein the imagewise exposing of the photosensitive composition to sufficient activating energy is conducted at a wavelength of about 193nm.

13. The method of claim 10 wherein the at least one water insoluble, acid decomposable polymer is substantially transparent to ultraviolet radiation at a wavelength of about 248nm; wherein the at least one photosensitive compound is capable of generating an acid upon exposure to sufficient activating energy at a wavelength of about 248nm; and wherein the imagewise exposing of the photosensitive composition to sufficient activating energy is conducted at a wavelength of about 248nm.

14. The method of claim 10 wherein the at least one water insoluble, acid decomposable polymer is substantially transparent to x-ray wavelength radiation; wherein the at least one photosensitive compound is capable of generating an acid upon exposure to sufficient activating energy at x-ray wavelengths; and wherein the imagewise exposing of the photosensitive composition to sufficient activating energy is conducted at an x-ray wavelength.

15. The method of claim 10 wherein the at least one photosensitive compound is capable of generating an acid upon exposure to sufficient activating electron beam radiation; and wherein the imagewise exposing of the photosensitive composition to sufficient activating energy is conducted by electron beam radiation.

16. The method of claim 10 wherein the irradiating to electron beam radiation is conducted at a temperature of from about –10 °C to about 10 °C.

17. The method of claim 10 wherein the irradiating to electron beam radiation is conducted at a temperature of from about –10 °C to about 5 °C.

18. The method of claim 10 wherein the irradiating to electron beam radiation is conducted under vacuum conditions.

19. A microelectronic device image produced by a process, which comprises:

(a) coating and drying a photosensitive composition onto a semiconductor substrate, which photosensitive composition comprises:

(a) coating and drying a photosensitive composition onto a semiconductor substrate, which photosensitive composition comprises:

(i) at least one water insoluble, acid decomposable polymer which is substantially transparent to ultraviolet or x-ray radiation, wherein said polymer is present in the photosensitive composition in an amount sufficient to form a uniform film of the composition components when it is coated on a substrate and dried;

(ii) at least one photosensitive compound capable of generating an acid upon exposure to sufficient activating ultraviolet, electron beam or x-ray radiation energy, said photosensitive compound being present in an amount sufficient to substantially uniformly photosensitize the photosensitive composition;

(b) imagewise exposing the photosensitive composition to sufficient activating ultraviolet, electron beam or x-ray radiation energy to cause the photosensitive compound to generate sufficient acid to decompose the polymer in the imagewise exposed areas of the photosensitive composition;

(c) developing the photosensitive composition to thereby remove the exposed nonimage areas and leaving the unexposed image areas of the photosensitive composition;

(d) irradiating the image areas of the photosensitive composition to sufficient electron beam radiation to thereby increase the resistance of the photosensitive composition in the image areas to an etchant while simultaneously cooling the

photosensitive composition during electron beam radiation to maintain the photosensitive composition at a temperature of less than about 20 °C.

20. An electron beam exposure apparatus which comprises

a) an enclosure;

b) an electrostatic chuck within the enclosure for holding a wafer during electron beam exposure, which electrostatic chuck comprises:

i) an electrically conductive wafer support having an electrically conductive top surface;

ii) a nonelectrically conductive layer on the wafer support;

iii) means for applying a substantially uniform electric field across said electrically conductive surface for holding a wafer on the support via the nonelectrically conductive layer;

b) an electron beam source within the enclosure which directs a wide, large beam of uniform electron beam radiation toward the wafer support;

c) a refrigerant within the enclosure which maintains a wafer positioned on the wafer support at a temperature of less than 20 °C during electron beam irradiation.

21. The apparatus of claim 22 wherein the refrigerant comprises a gas.

22. The apparatus of claim 22 wherein the refrigerant comprises a heat dissipation device.